

MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate culture of non-violence and truthfulness through Vipassana.

To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो ,

अत्ताहि अत्त नो गति

अत्त मार्गपर अप्रमादसे है तुझे चलना

सब्ब का कल्याण हो ,

वो कार्यकुशल करना

सब्ब का उत्तम मंगल , पथप्रदर्शक हो

अत्त दिप भव भव प्रदिप भव ,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

Dr. G. Y. Pathrikar College of Computer Science & Information Technology

MGM college of Computer Science and Information Technology was established in 2001 offering undergraduate and postgraduate degree program in Computer Science and Information Technology. College was renamed as Dr.G.Y.Pathrikar College of Computer Science and Information Technology in 2003 in memory of great educationalist, one of the founder member and Ex-Secretary MGM, Dr.G.Y.Pathrikar Sir.

It is first self-financed ISO certified institution offering program dedicated to Computer science and Information technology in Maharashtra and has achieved status of 2f/12b. Ours was the only and first college to be re-accredited as A+ grade with NAAC in the year 2017. Experienced and qualified faculty with Ph.D is strength of our college. Starting with 77 student's College has crossed total students strength of 10,000 passing out. Student are doing well in various MNCs like Infosys, Tech-Mahindra, Wipro, Capgemini, Cognizant etc. Many have their own Startups. Some of the students have completed their Masters and Ph.D. program from foreign countries like US, UK, Australia. Now we are constituent college of MGM University, Chhatrapati Sambhajanagar.

Vision

To be an academic institution in dynamic equilibrium in social, ecological and economical environment striving continuously for excellence in total quality education, research and technological service to the nation.

Mission

- To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, and economical issues.
- To upgrade our students in all respect with the help of latest infrastructure in the area of Computer Science and Information Technology in order to build the National Capabilities.
- To understand the culture of Non-violance, truth, peace through Gandhian Philosophy.

Programs offered at Dr. G. Y. Pathrikar College of Computer Science & Information Technology

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes
B.Sc(Computer Science) Honours / Honours with Research	M.Sc(Computer Science)	Ph.D. in Computer Science and Information Technology
B.Sc(Information Technology) Honours/ Honours with Research	M.Sc(Information Technology)	
BCA(Science) Honours / Honours with Research	M.Sc(Data Science)	
B.Sc(Animation) Honours / Honours with Research	M.Sc(Animation)	
Integrated M.Sc. Data Science		
BCA(Digital Marketing) Honours		
B.Sc(Robotics) Honours		

MGMUNIVERSITY

Name of Program – M.Sc. (Computer Science)

Duration – Two Years

Eligibility -

- Any Science Graduate with Computer Science as one or all subject or graduate of engineering and technology of this University or any other recognized university as equivalent with minimum 50% marks (45% for reserved category) can apply.

MGMUNIVERSITY

Name of Faculty: Basic and Applied Sciences

Name of the College/Institute/Department/School: Dr. G. Y. Pathrikar College of CS & IT

Name of the Programme: M. Sc. (Computer Science)

Programme Type (UG/PG): PG

Duration: 2 Years

First Year - Semester I												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML501	Digital Image Processing	Major	3	3	-	60	40	100	--	16	40
MM	MCS41MML502	Data Warehousing	Major	3	3	-	60	40	100	--	16	40
MM	MCS41MML503	Web Development and JavaScript	Major	3	3	-	60	40	100	-	16	40
RM	MCS41RML501	Research Methodology	Compulsory	4	4	-	60	40	100	-	16	40
ME		Elective from Basket-1	Elective	3	3	-	60	40	100	-	16	40
MM	MCS41MMP501	Practical Based on Digital Image Processing	Major	1	-	2	30	20	50	-	08	20
MM	MCS41MMP502	Practical based on Data warehousing	Major	1	-	2	30	20	50	-	08	20
MM	MCS41MMP503	Practical Based on Web Dev. Using JavaScript	Major	1	-	2	30	20	50	-	08	20
ME		Practical based on elective-1	Elective	1	-	2	30	20	50	-	08	20
Total				20	16	8	420	280	700	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

First Year- Semester II												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	MCS41MML504	Pattern Recognition	Major	3	3	-	60	40	100	--	16	40
MM	MCS41MML505	Data Mining and Visualization	Major	3	3	-	60	40	100	--	16	40
MM	MCS41MML506	Python Programming	Major	3	3	-	60	40	100	--	16	40
ME		Elective from Basket-2	Elective	3	3	-	60	40	100	--	16	40
MM	MCS41MMP504	Practical Based on Pattern Recognition	Major	1	-	2	30	20	50	--	08	40
MM	MCS41MMP505	Practical based Data Mining & Visualization	Major	1	-	2	30	20	50	--	08	20
MM	MCS41MMP506	Practical Based Python Programming	Major	1	-	2	30	20	50	--	08	20
ME		Practical based on elective	Elective	1	-	2	30	20	50	--	08	20
OJT	MIT41JTJ501	On Job Training / Internship	Project	4	-	8	60	40	100	--	--	40
Total				20	12	16	420	280	700	--	--	--

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project.

Elective Baskets

Basket-1

Code	Title
MCS41MEL501	Data Management Tools
MCS41MEL502	Data Structure and Algorithm
MCS41MEL503	Advance Operating System
MCS41MEL504	Cloud Computing with AWS
MCS41MEP501	Practical Based on Data Management Tools
MCS41MEP502	Practical Based on Data Structure and Algorithms
MCS41MEP503	Practical Based on Adv. Operating System
MCS41MEP504	Practical Based on Cloud Computing with AWS

Basket-2

Code	Title
MCS41MEL505	Intellectual Property Rights
MCS41MEL506	React JS
MCS41MEL507	Neural Network
MCS41MEL508	Ethics and Cyber Security
MCS41MEP505	Practical Based on Intellectual Property Rights
MCS41MEP506	Practical Based on React JS
MCS41MEP507	Practical Based on Neural Network
MCS41MEP508	Practical Based on Ethics and Cyber Security

Basket-3

Code	Title
MCS41MEL601	Latex
MCS41MEL602	Data Analytics
MCS41MEL603	Neural Network with Fuzzy Logic
MCS41MEL604	Native React
MCS41MEP601	Practical Based on Latex
MCS41MEP602	Practical Based on Data Analytics
MCS41MEP603	Practical Based on Neural Network with Fuzzy Logic
MCS41MEP604	Practical Based on Native React

Basket-4

Code	Title
MCS41MEL605	Natural Language Processing
MCS41MEL606	Quantum Computing
MCS41MEL607	Software Testing and Verification
MCS41MEL608	Digital Forensics
MCS41MEP605	Practical Based on Natural Language Processing
MCS41MEP606	Practical Based on Quantum Computing
MCS41MEP607	Practical Based on Software Testing and Verification
MCS41MEP608	Practical Based on Digital Forensics

Syllabus

Semester-I

Course code: MCS41MML501

Course name: Digital Image Processing

Course category: Major Mandatory

Credits: 3

Pre-requisites: Basics of mathematics

Course Objectives:

1 To improve pictorial information for human interpretation.

2 Processing of image data for tasks such as storage, transmission and extraction of pictorial information

Course Outcomes: At the end of the course, the students will be able to -

CO1 : Understand the basic digital image processing operations

CO2: Get familiar with the principal techniques used for spatial and frequency domain.

CO3: Design GUI using digital image processing techniques

CO4: Understand the fundamentals of color and different color models.

Contents –

Unit	Topics to be Covered	No. of Lectures
1	<p>Introduction What is Digital Image Processing? Applications of Image Processing, Fundamental Steps of Digital Image Processing, Components of an Image Processing System. Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition : Image Acquisition using a Single Sensor, Sensor Strips and Sensors Array, Image Sampling and Quantization.</p>	8
2	<p>Image Enhancement and Filtering Techniques: Intensity Transformation Function, Histogram Processing, Spatial Filtering, Spatial Correlation and Convolution, Generating Spatial Filter Mask, Smoothing Spatial Filters, Sharpening Spatial Filter. The Fourier Transform of Sampled Functions, Discrete Fourier Transform. A Model of Image Degradation/Restoration Process, Noise Models, Mean Filter, Order-Statistics Filter, Adaptive Filter, Bandpass Filter and Notch Filter. Wavelet Function, Wavelet Transform, Fast Wavelet Transform</p>	8
3	<p>Image Compression and Morphological Operations Image Compression: Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Image Compression Models. Morphological Operations: Erosion, Dilation, Duality, Opening and Closing, The Hit-or- Miss Transformation. Morphological Algorithms: Boundary Extraction, Hole Filling, Thinning, Thickening, Skeleton Pruning.</p>	10

4	Image Segmentation Point, Line, and Edge Detection: Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection. Thresholding: Basic Global Thresholding, Optimum Global Thresholding Using Otsu Method, Multiple Threshold, Variable Threshold Region-Based Segmentation: Region Growing, Region Splitting and Merging	8
5	Color Image Processing: Color Fundamentals, Color Model : RGB, CMY, CMYK, HSI, Pseudocolor, Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images.	10

Text Books: 1. Rafael C Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, India 3 rd Edition
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall
Reference Books: 1. Kenneth R. Castleman, Digital Image Processing, Pearson Education, India
2. Rafael C Gonzalez, Richard E. Woods, Steven L. Eddins, Image Processing Using MATLAB, McGraw Hill, 2 nd Edition
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MMP501	Practical Based on Digital Image Processing	--	1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Perform the different operations of different steps included in Digital Image Processing on an image							

List of Practicals:

Experiment No.	Experiment Topics
1	Write program for Histogram Equalization and Histogram Matching
2	Write program for Discrete Fourier Transform
3	Write program for Smoothing Sharpening Spatial Filter
4	Write program for Wavelet Transform
5	Write program for Image Compression
6	Write program for Image Segmentation using Thresholding
7	Write program for Line Detection
8	Write program for Noise Models
9	Write program for Region Growing
10	Write program for Color Model (RGB, CMY, CMYK, HSI)

Course code: MCS41MML502

Course name: Data Warehousing

Course category: Major Mandatory

Credits: 3

Pre-requisites: Pre-university mathematics

Course Objectives:

To have an understanding of the foundations, the design and maintenance.

Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases,

Course Outcomes:

CO1 : Learning the steps for the preparation of plan to implement data warehouse.

CO2: To have an understanding of the evolution and the use of data warehouses

CO3: Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining.

CO4: being able to use a powerful tool for dimensional modeling and analysis.

Contents –

UNIT	Topics to be covered	No. of Lect.
I	<p>Data Warehousing Concepts: Need for Data Warehouse, History</p> <p>Data Warehouse: The building blocks: Features of Data Warehouse, Top down vs. Bottom up approach, Architectural types: centralized data warehouse, independent data marts, Federated.</p>	8
II	<p>Components of Data Warehouse: Source data component, data staging component, data storage component, information delivery component, metadata component, management and control component.</p> <p>Metadata in the data warehouse: types of metadata, special significance of metadata.</p>	10
III	<p>Trends in Data Warehousing: Continued growth in data warehousing, expansion, significant trends: Real time data warehousing, multiple data types, data visualization, parallel processing, data warehouse appliances, query tools, browser tools, data fusion, data integration, Analytics, Data Warehousing and CRM, Agile development.</p> <p>Emergence of Standards: Metadata, OLAP</p>	10
IV	<p>Web Enabled Data warehouse: The warehouse to the web, The web to the warehouse, The web enabled configuration.</p> <p>Planning and project management: Planning your Data Warehouse, Justify how different is your project, assessment of readiness, The life cycle approach, The development Phases: Adopting Agile technology, The Project team organization and management.</p>	10

V	<p>Requirement Gathering Methods: Types of questions, arrangement of questions, interview techniques, Adapting JAD methodology, Using Questionnaires, Review existing documentation</p> <p>Scope and content: Data source, data transformation, data storage, Information delivery, Information package diagrams.</p> <p>Data Design and architectural plan: Structure for Business Dimensions, Structure for Key measurements, levels of detail, composition of components, tools and products.</p>	08
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Text Book : 1 Paulraj Ponniah, Data Warehousing – Fundamentals for IT professionals, Willey Publication, 2nd Edition .

Reference Book: Kimball, Reeves Ross, Thornthwaite., The Data Warehouse Lifecycle Toolkit, John Wiley & Sons.

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			Total
					ESE	PR		
MCS41MMP502	Practical Based on Data Warehousing	--	1	30	20	50	1	
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	To create, control, navigating dimensional databases by powerful tools for modeling and analysis..							

List of Practicals :

At least two experiments should be carried out on each unit.

Course code: MCS41MML503
Course category: Major Mandatory

Course name: Web Development and JavaScript
Credits: 3

Pre-requisites: Basic knowledge of web development

Course Objectives:

1. To provide the general mechanism and design of Automatic system
2. Create highly responsive interfaces that improve the user experience and provide dynamic functionality.

Course Outcomes:

CO1 : Know variable naming rules and JavaScript data types

CO2 : Identify expressions and operators

CO3 : Handling Web Page.

CO4 : Creating websites

Contents –

UNIT	Topics to be Covered	No. of Lect.
I	<p>Introduction:</p> <p>Introduction to HTML, Internet, Web server, web client/ browser, HTML Tags, Paired tags, Singular tags, Commonly used HTML commands: Structure of HTML Program, Titles, footers, text formatting, text styles, text effects, Lists, Types of list</p>	08
II	<p>Adding graphics to HTML Page</p> <p>Using the Border attribute, Using the width and height attribute, Using the align attribute, Linking documents, hyperlinks to a file, images as hyperlinks, image maps</p> <p>Frames:</p> <p>Introduction to frames, <FRAMESET>, <FRAME> tag, targeting named frames</p>	08
III	<p>Working with CSS</p> <p>Introduction to CSS, style sheets and HTML text properties: font, length, line box, text formatting, coloring, CSS Box model: properties, shorthand properties, background colors and images, Style properties, tables, lists.</p>	08
IV	<p>JavaScript Basics and Strings</p> <p>Basics and advantages of JavaScript, JavaScript in web pages: database connectivity, client-side JavaScript, Capturing User input, writing JavaScript into HTML, Data Type and literal: Number, Boolean, string, null, creating variables, Operators and its types, JavaScript arrays, Elements of Arrays.</p> <p>JavaScript decision making</p> <p>Decision Making with code, IF Statement, Else-if, Else, for loop, while loop, Built in functions</p>	10

V	Forms used by a website: Properties of form elements, methods of form elements, text element, password element, button element, submit element, checkbox element, radio element, text area element, select and option element	08
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Text Book : 1 Ivan Bayross, HTML, JavaScript, DHTML and PHP, BPB Publication, 4 th edition.
Reference Book: Jeffrey C. Jackson, Web Technologies: A computer science perspective, LPE Publication.
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			Total
					ESE	PR		
MCS41MMP503	Practical Based on Web Development and JavaScript	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Able to create website or web based application							

List of Practical's:-

At least two experiments should be carried out on each unit.

Course code: MCS41RML501

Course name: Research Methodology

Course category: Research Methodology

Credits: 4

Pre-requisites: Importance of research

Course Objectives:

1 To understand the state-of-the-art in research methodology.

2. Survey the currently available systems

Course Outcome:

CO1: Demonstrate knowledge of research methodology. Understand the Research Problem

CO2: Understand the Research Design

CO3: Understand Sampling Design, Measurement and Scaling Techniques

CO4: Understand methods of Data Collection, Processing and Analysis of data

Contents –

UNIT	Topics to be covered	No. of Lecture
A	Introduction: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods Verses Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Research in India.	08
B	Defining the Research Problem: What is Research Problem? Selecting the Problem, Necessity Of Defining the Problem, Techniques Involved in Defining a Problem	10
C	Research Design: Meaning of Research Design, Need of Research Design, Features of Good Design, Important Concepts Relating to Research Design, Different Research Design, Basic Principles of Experimental Designs.	10
D	Sampling Design, Measurement and Scaling Techniques: Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design. Measurement in Research, Sources of Error in Measurement, Meaning and Scaling.	10
E	Methods of Data Collection, Processing and Analysis of Data: Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Questionnaires Schedules, Processing Operations, Some Problems in Processing, Statistics in Research, Simple Regression Analysis.	10

Text Book : 1 C. R. Kothari, Research Methodology Methods and Techniques, New Age International Publisher, 2nd Edition

Reference Book: P. Sam Daniel, Aroma G. Sam, Research Methodology, Gyan Publishing House, 1st Edition

Course code: MCS41MEL501	Course name: Data Management Tools
Course category: Major Elective	Credits: 3
Pre-requisites: Basic Knowledge of database	
Course Objectives:	
1. Students can design new database and modify existing ones for new or existing applications	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: To know the different issues involved in the design and implementation of a database system.	
CO2: Can use data manipulation language to query, update, and manage a database.	
CO3: Essential DBMS concepts such as: database security, integrity, concurrency, etc..	
CO4: To analyze data, choose relevant models and algorithms for respective applications.	

Contents –

Section	Topics to be covered	No. of Lect.
A	<p>Unit-I: Overview of Database Concepts: Database and Need for DBMS, Characteristics of DBMS, Database Users, 3-tier architecture,(its advantages over 2-tier), Database Components: Users, facilities & Structure, Abstraction & Data Integration,</p> <p>Entity-Relationship Data model: Entity, Entity set, Types of Entities, Attributes, Types of Attributes, Relationship, Types of Relationship, Representation of Entity, Attributes & Relationship, Keys, Types of keys Mapping Cardinality.</p> <p>Introduction to SQL– create, insert, update, delete, drop, alter, SELECT (distinct, where, and, or, not, like, between, like, order by, group by, having etc.), inner (nested) queries, aggregate functions, numeric functions, string functions, date functions, create user/role, grant/revoke privileges, views.</p>	12
B	<p>Unit-II: Relational Database design: Anomalies, Types of Anomalies, Functional dependencies, Integrity Rules: Rule 1 & 2</p> <p>Normalization: Normal forms (1 NF, 2 NF, 3 NF, BCNF, 4 NF), Conversion From Universal to 1NF, 1NF to 2NF, 2NF to 3NF.</p> <p>Relational Algebra:</p> <ul style="list-style-type: none"> ○ Union, Intersection, difference, Cartesian Product, Selection, Projection, Join(Inner & Outer) , Division with examples 	12
C	<p>Unit-III: Introduction: - What is data mining, DBMS Vs Data Mining, DM Techniques, Challenges, Other issues, Understanding Data, DM Applications-Case Studies, Current Trends Affecting DM, Basic Data Mining Task. Relations to Database, Statistics, Machine Learning</p>	12

	Association Rule :- What is an Association rule?, Mining, Level-wise Method, FP-Tree Method, Other Variants, A Priori Algorithm, Partition Algorithm.	
D	Unit-IV: Classification: - Decision Tree Algorithm, CART, PUBLIC, Pruning Classification Tree, and Decision Tree, What is a decision tree? Tree Construction Principle, Best Split, Splitting indices, Splitting Criteria Web Mining: Introduction, Web Content Mining, Web Structure Mining, and Web Usage Mining.	12
E	Unit-V: Clustering Techniques: Clustering Paradigm, Partitioning Algorithm, Similarity and Distance Measure, Hierarchical Algorithm, Rough Set Theory and its Application to Data Mining ROC Analysis:- Data Mining Trends, Big Data, Data Analytics	12

<p>Text Book : 1. Silberschatz, Korth and Sudarshan, “Database System Concepts”, 5th/6th Edition 2. R. Elmasri; S. Navate; Benjamin Cummings, “Fundamental of Database Systems”. 3. Bipin Desai, “Database Management Systems”.</p>
<p>Reference Book: 1. Jackson, “Relational database design for Micro computers Application”, , Prentice Hall. 2. Arun K. Pujari, “Data Mining Techniques”, Kindle 3rd Edition 3. M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 4. Morgan Kaufman, “Data Mining: Concepts & Techniques”, 3rd Edition</p>
<p>Online Resources: 1. NPTEL / SWAYAM lectures.</p>

Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credit
		L	P	Internal	External		Total	
					ES	PR		
MCS41MEP501	Practical Based on Data Management Tools	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Able to create website or web based application							

Contents-

Experiment No.	Experiment Topics
1.	Creating database tables and using data types. • Create table, • Modify table, • Drop table
2.	Practical Based on Data Manipulation. • Adding data with Insert, • Modify data with Update, • Deleting records with Delete
3.	Practical Based on Implementing the Constraints. • NULL and NOT NULL, • Primary Key and Foreign Key Constraint • Unique, Check and Default Constraint
4.	Practical for Retrieving Data Using following clauses. • Simple select clause, • Accessing specific data with Where, Ordered by, Distinct and Group By with having clause
5.	Practical Based on Aggregate Functions. • AVG, • COUNT, • MAX, • MIN, • SUM, • CUBE
6.	Study various data mining tools
7.	Search and Download data set from UCI for data mining techniques and algorithms.
8.	Dealing with Missing data (Data cleaning method) in MS Excel
9.	Execute and analyze A-priori algorithm using data mining tool
10.	Execute and analyze information gain for decision tree using Data Mining tool
11.	Execute and analyze K-Means clustering algorithm using Orange or any tool.

Course code: MCS41MEL502**Course name:** Data Structure and Algorithm**Course category:** Major Elective**Credits:** 3**Pre-requisites:** Basic Knowledge of Languages**Course Objectives:**

1. To understand the different methods of organizing large amount of data & efficiently implement the different data structures.

Course Outcomes: At the end of the course, the students will be able to -

CO1: To use well-organized data structures in solving various problems.**CO2:** To differentiate the usage of various structures in problem solution.**CO3** Implementing algorithms to solve problems using appropriate data structures.

Contents-

Section	Topics to be Covered	No. of Lectures
A	Unit I Overview: Introduction Need of Data Structure Definitions - Data and information, Data type, Data object, ADT, Data Structure Types of Data Structures ,Introduction to Algorithm, Analysis of algorithm, Space and time complexity,	05
B	Unit II Array as a Data Structure ADT of array, Operations Array applications - Searching Sequential search, variations - Sentinel search, Probability search, ordered list search Binary Search Comparison of searching methods Sorting Terminology- Internal, External, Stable, In-place Sorting Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies	10
C	Unit III Linked List List as a Data Structure, differences with array Dynamic implementation of Linked List, internal and external pointers Types of Linked List – Singly, Doubly, Circular Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.	10
D	Unit IV Stack : Introduction Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.Applications of stack Queue: Introduction Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack. Implementation - Static and Dynamic with comparison Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)	10

E	<p>Unit V</p> <p>Graphs: Introduction to Graph Theory, Graph isomorphism, Graph data structures: Adjacency lists, Adjacency matrices Elementary graph Algorithms: BFS, DFS, Topological sort, strongly connected Components</p> <p>Trees: Introduction to Trees, Tree traversals (preorder, inorder and postorder), Binary trees</p>	10
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<p>Text Book : 1. Thomas Cormen, “Introduction to Algorithm” 2. Alfred V.Aho, , O’Really, “Data structures and Algorithms”</p>
<p>Reference Book: Ellis Horowitz, O’ Reilly, “Fundamentals of Data Structures in c++”</p>
<p>Online Resources: 1. NPTEL / SWAYAM lectures.</p>

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Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External ESE	PR		Total
MCS41MEP502	Practical Based on Data Structure and Algorithm	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Student get familiar with the basic concepts of data structures and algorithms. Student can implement practically searching and sorting techniques.							

List of Practicals:

Experiment No.	Experiment Topics
1	Program for traversing of n item using the array
2	Write and execute programs for push and pop operation using the stacks
3	Write and execute programs for insertion and deletion of n item from the Queues
4	Implement a program for Circular Doubly Linked List
5	Implement a program to display a Linked List.
6	Write and execute a program for binary search algorithm
7	Write and execute a program for Bubble sort Algorithm
8	Write and execute a program for implementation of insertion sort
9	Write and execute a program for demonstration of merge sort
10	Write an algorithm to sort 'n' number of elements using selection sort

Course code: MCS41MEL503
Course category: Major Elective

Course name: Advance Operating System
Credits: 3

Pre-requisites: Basic Knowledge of Operating System

Course Objectives:

1. Understand structure and organization of computer system.
2. To understand the functions of operating system which manages the computer's resources, establish a user interface, execute and provide services for applications software.

Course Outcomes: At the end of the course, the students will be able to -

CO1: The student will analyse and evaluate computer system hardware

CO2: Understand how the Operating System establish the interface between the user and computer system.

CO3 The student will get the knowledge of different types of Managements like memory management, Processor Management, I/O Management, File management etc. done by the Operating System

Contents-

Section	Topics to be Covered	No. of Lectures
A	Unit I Distributed Computing: The Parallel Computation View-I Introduction, The fifth generation project and the strategic Computing Initiative, Super Computer Projects, Classification of sequential and Parallel Architecture, Pipelining, Vector Processing Array Preprocessors, Data Flow Computers, Multiprocessors, Fault Tolerance	9
B	Unit II Distributed Computing: The Parallel Computation View-II Computational Complexity Issue, Detecting Parallelism, Processor interconnection Schemes, Loosly Coupled Vs. Tightly Coupled Systems, Fetch and add, Multiprocessor Operating System Organization Scheduling Criteria, Scheduling Algorithm, Multi-Process Scheduling, Real-Time Scheduling.	9

C	Unit III Disk Performance Optimization Introduction, Operation of Moving Head Storage, Why disk Scheduling is necessary? Desirable Characteristics of Disk Scheduling Policies, Seek Optimization, Rotational Optimization, Systems Consideration, Disk Caching, Other Performance Enhancement Techniques, RAM Disks, Optical Disks	9
D	Unit IV File and Database Systems- I Introduction, The File System, File System Functions, The Data Hierarchy, Blocking and Buffering, File Organization, Queued and Basic Access Methods, Allocating and Freeing Space, File Descriptor	9
E	File and Database Systems- I Access Control Matrix, Access Control by User Classes, Backup and Recovery, File Servers, Distributed File Systems, CD-ROM, WORMS Magneto-Laser Disks, Database Systems, Database Models	8

Text Book : 1 H. M. Deitel Deitel & Associates, “Operating Systems”, 3 rd Edition 2. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts”, John Wiley & Sons, 6 th Edition.
Reference Book: 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Principles” Wiley- India Publisher, 7 th Edition. 2. M. Naghibzadeh, “Operating System: Concepts and Techniques” I Universe
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			Total
					ESE	PR		
MCS41MEP503	Practical Based on Advance Operating System		1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Implementation of Algorithms							

List of Practical's:-

At least two experiments should be carried out on each unit.

Course code: MCS41MEL504
Course category: Major Elective

Course name: Cloud Computing with AWS
Credits: 3

Pre-requisites: Basic Knowledge of networking & Linux operating system

Course Objectives:

- 1 Understanding basics of cloud computing
2. Key concepts of virtualization and different cloud computing services.

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand Cloud Computing

CO2: Understand the use of Cloud Computing

CO3: Learn the Concept of Cloud Infrastructure. Understand Business imperative of Cloud Computing

CO4: AWS – Cloud Computing basics

Contents-

Section	Topics to be Covered	No. of Lectures
A	<p>Unit I: Understanding Cloud Computing: An Introduction to Cloud Computing, Why Cloud Computing? Components of cloud computing, Essential Characteristics of Cloud Computing ,Service Models in Cloud computing: Public Cloud, Private Cloud, Hybrid Cloud, Community, Cloud Deployment models in Cloud Computing: SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service).</p>	09
B	<p>Unit II: AWS: Amazon Web Services: Introduction to AWS, Global infrastructure of AWS, Region, Availability Zone, Edge Locations, AWS Platform. Cloud Domain: Security & Identity Compliance, Compute domain, Storage domain, Network and Content Delivery, Database domain.</p>	08
C	<p>Unit III: Identity Access Management (IAM): Introduction to IAM, Root User, IAM user, Multi Factor Authentication for Users, IAM Password Policies, Access Key ID and Secret Access Key, AWS Managed Policies, Customer Managed Policies.</p>	
D	<p>Unit IV: Amazon Elastic Compute Cloud (Amazon EC2): Introduction to EC2, EC2 Vs Traditional Computing, EC2 Instance Life-Cycle, Launching a Windows Instance, Launching a Linux Instance, Security Groups, EC2 Instance Types: On-Demand Instances, Reserved Instances, EC2 Vertical Scaling & Horizontal Scaling,</p>	10

E	<p>Unit V: Amazon Simple Storage Service (S3): Introduction to S3, Object based storage Vs File System Storage, Storage Classes, Versioning, Access Control Lists, Cross-region replication, S3 storage automation with Life Cycle Management.</p> <p>Virtual Public Cloud(VPC): Introduction VPC, Networking Basics: IPv4 Classes, Public IP Vs Private IP, Subnets, NAT. VPC Basics: Default VPC, Custom VPC</p>	09
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<p>Text Book : 1 Miller, “Cloud Computing”, Pearson Education India 2. Pandey U.S. &Chaudhary Kavita, “Cloud Computing”, S. Chand Publishing</p>
<p>Reference Book: 1. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud” 2. Ben Piper, David Clinton, “AWS Certified Solutions Architect Study Guide Ben Piper,David Clinton”, 3rd Edition.</p>
<p>Online Resources: 1. NPTEL / SWAYAM lectures.</p>

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Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MEP504	Practical Based on Cloud Computing with AWS		1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	<ul style="list-style-type: none"> • Understanding basics of cloud computing. • Key concepts of virtualization and different cloud computing services. • AWS – Cloud computing basics. 							

List of Practicals:

Experiment No.	Experiment Topics
1	Study of cloud computing & Architecture.
2	Hands on Activity for virtual box Installation.
3	Study cloud Deployment Model in details.
4	Study of Identity Access Management (IAM).
5	Create User, Group, and Policies & Role using IAM.
6	Study of EC2? Create one windows EC2 instance and Login to the Windows EC2 Instance.
7	Create a Linux EC2 Instance and Login to the Linux EC2 Instance.
8	Create a Linux EC2 instance and Host a simple Website.
9	Study of S3 services & S3 life cycle rule.
10	Create S3 bucket in any region and upload any object to the S3 bucket.
11	Study of Virtual Private Network.

Course code: MCS41MML504

Course name: Pattern Recognition

Course category: Major Mandatory

Credits: 3

Pre-requisites: Basic Knowledge of networking & Linux operating system

Course Objectives:

To provide the general mechanism and design of Automatic system recognition.

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understands basic structure of pattern recognition systems

CO2: Defines the relationship between pattern and feature.

CO3: Explains supervised and unsupervised pattern recognition approaches.

Contents-

Section	Topics to be covered	No. of Lect.
UNIT I:	Introduction to Pattern Recognition, Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features	08
UNIT II:	Maximum Likelihood and Bayesian Estimation: Parameter estimation methods, Maximum- Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.	10
UNIT III:	Non-parametric : Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification. Linear Discriminant function based classifiers: Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)	
UNIT IV:	Multilayer Neural Network: Feed Forward Classification, Back Propagation Algorithm, Error Surface Stochastic Data: Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming.	08
UNIT V:	Non-metric methods for pattern classification: Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method. Unsupervised learning and clustering : Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis	10

Book Text: 1 R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification" John Wiley, 2007 2nd Edition

Reference Book: 1. Christopher M. Bishop, "Neural Network for Pattern Recognition" Oxford Ohio Press

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MMP504	Practical Based on Pattern Recognition	-	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Extraction of patterns from the input data and analysis of the data							

List of Practical's:-

At least two experiments should be carried out on each unit.

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Course code: MCS41MML505

Course name: Data Mining and Visualization

Course category: Major Mandatory

Credits: 3

Pre-requisites: Basic knowledge of Data Science

Course Objectives:

1 Students will be able to actively manage and participate in data mining projects. To develop research interest towards advances in data mining

2..Students will be able to understand the visualization techniques

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand the Data Mining

CO2: Understand How to Explore Data

CO3: Understand Classification

CO4: Understand Classification Techniques

Contents-

Section	Topics to be covered	No. of Lect.
A	<p>UNITI:</p> <p>Introduction to Data Mining: Why Mine Data? Commercial Viewpoint, Scientific Viewpoint Motivation, Definitions, Origins of Data Mining, Data Mining Tasks, Classification, Clustering, Association Rule Discovery, Sequential Pattern Discovery, Regression, Challenges of Data Mining, Data Mining Data: What is Data? Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density</p>	09
B	<p>UNITII:</p> <p>Data Mining: Exploring Data: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations, Data Mining Classification: Basic Concepts, Decision Trees, and Model Evaluation: Classification: Definition, Classification Techniques, Tree Induction, Measures of Node Impurity, Practical Issues of Classification, ROC curve, Confidence Interval for Accuracy, Comparing Performance of Two Models, Comparing Performance of Two Algorithms.</p>	09

C	<p>Unit III Data Mining Association Analysis: Basic Concepts and Algorithms: Association Rule Mining, Frequent Item set Generation, Association Rule Discovery : Hash tree, Factors Affecting Complexity, Maximal Frequent Horible Closed Itemset, Alternative Methods for Frequent Item set Generation, FP growth Algorithm, Tree Projection, Rule Generation, Pattern Evaluation, Statistical Independence, Properties of A Good Measure, Support-based Pruning, Subjective Interestingness Measure.</p>	09
D	<p>Unit IV DataMiningClusterAnalysis:BasicConceptsand Algorithms: Applications of Cluster Analysis, Types of Clusters, Clustering Algorithms: K- means and itsvariants,Hierarchicalclustering,Densitybasedclustering.Graph-BasedClustering, Limitations of Current Merging Schemes, Characteristics of Spatial Data Sets, Shared Near Neighbor Approach, ROCK (Robust Clustering using linKs), Jarvis-Patrick Clustering, SNN Clustering Algorithm, Data Mining Anomaly Detection: Anomaly/Outlier Detection, Importance, Anomaly Detection Schemes, Density-based: LOF approach.</p>	09
E	<p>UNITV: IntroductiontoDataVisualization – Classification of Visualization techniques – Structure and representation – Selection of a Visualization – Visualizations for high dimensional data – Graphics and computing, Principles of Data Visualization : Multivariate data – Linked data – Visualizing trees and forests – Large Datasets – Plots and their variates – Visualizing cluster analysis – contingency tables – finite mixture models, Methodologies: Visualization inBayesian data analysis – Matrix visualization – Data visualization by kernel machines .Applications : Visualization for genetic network reconstruction, medical images, financial dataset and Insurance risk processes.</p>	09

<p>Book Text: 1 Tan, Steinbach, Kumar. “IntroductiontoDataMining” 2. Jiawei Han, MichelineKamber, “DataMining:Conceptsand Techniques” Morgan Kaufmann Publishers 3. C.R.Rao, “PrinciplesofDataMining”, North Holland</p>
<p>Reference Book: 1. Usama Fayyad,,Georges G., Grinstein and Andreas Wierse, “Information visualization in Data Mining and Knowledge discovery” Morgan kaufmann publishers, 2002 Chun-houhChen, 2. Wolfgang Hardleand Antony Unwin, “HandbookofDataVisualization” Springer, 2008</p>
<p>Online Resources: 1. NPTEL / SWAYAM lectures.</p>

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MMP505	Practical Based on Data Mining and Visualization	--	1	30	-	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Identify appropriate datamining algorithms to solve real world problems							

List of Practical's:-

Sr.No	List of Practical
1.	Demonstration of preprocessing on dataset student.arff
2.	Demonstration of preprocessing on dataset labor.arff
3.	Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm
4.	Demonstration of Association rule process on dataset test.arff using apriori algorithm
5.	Demonstration of classification rule process on dataset using Nearest neighbor algorithm
6.	Demonstration of classification rule process on dataset using K-NN algorithm
7.	Demonstration of classification rule process on dataset using Decision tree algorithm
8.	Demonstration of classification rule process on dataset using Regression algorithm
9.	Apply Visualization techniques for Various Dataset
10.	Apply Visualization techniques for Various Dataset
11.	Apply Visualization techniques for Various Dataset

Course code: MCS41MML506

Course name: Python Programming

Course category: Major Mandatory

Credits: 3

Pre-requisites: Basic knowledge Programming

Course Objectives:

1 Building robust applications using Python programming language's features.

2.. Understanding the usage of Python libraries.

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand python programs that solve simple business problems.

CO2: Error Handling in python, pandas, Jupyter, Notebook. Plot and data visualization

CO3: Missing Data Identification and understanding

CO4: Business Data predication tool design

Contents-

Section	Topics to be covered	No. of Lect.
A	<p>UNIT 1</p> <p>IPython: Beyond Normal Python: Shell or Notebook?, Launching the IPython Shell, Launching the Jupyter Notebook, Help and Documentation in IPython, Accessing Documentation with?, Accessing Source Code with ?, Exploring Modules with Tab Completion, Keyboard Shortcuts in the IPython Shell, Navigation Shortcuts, Text Entry Shortcuts, Command History Shortcuts, Miscellaneous Shortcuts, IPython Magic Commands, Pasting Code Blocks: %paste and %cpaste, Running External Code: %run, Timing Code Execution: %timeit, Help on Magic Functions: ?, %magic, and %lsmagic, Input and Output History, IPython's In and Out Objects, Underscore Shortcuts and Previous Outputs, Suppressing Output, Related Magic Commands, IPython and Shell Commands, Quick Introduction to the Shell, Shell Commands in IPython, Passing Values to and from the Shell, Shell-Related Magic Commands, Errors and Debugging, Controlling Exceptions: %xmode, Debugging: When Reading Tracebacks Is Not Enough, Profiling and Timing Code, Timing Code Snippets: %timeit and %time, Profiling Full Scripts: %prun, Line-by-Line Profiling with %lprun, Profiling Memory Use: %memit and %mprun</p>	10
B	<p>UNIT 2</p> <p>Introduction to NumPy: ○ Understanding Data Types in Python, A Python Integer Is More Than Just an Integer, A Python List Is More Than Just a List, Fixed-Type Arrays in Python, Creating Arrays from Python Lists, Creating Arrays from Scratch, NumPy Standard Data Types, The Basics of NumPy Arrays, NumPy Array Attributes, Array Indexing: Accessing Single Elements, Array Slicing: Accessing Subarrays, Reshaping of Arrays, Array Concatenation and Splitting, Computation on NumPy Arrays: Universal Functions, The Slowness of Loops, Introducing UFuncs, Exploring NumPy's UFuncs, Advanced Ufunc Features, Ufuncs: Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Computation on Arrays: Broadcasting, Introducing Broadcasting, Rules</p>	10

	of Broadcasting, Broadcasting in Practice, Comparisons, Masks, and Boolean Logic, Example: Counting Rainy Days, Comparison Operators as ufuncs, Working with Boolean Arrays, Boolean Arrays as Masks, Fancy Indexing, Exploring Fancy Indexing, Combined Indexing, Example: Selecting Random Points, Modifying Values with Fancy Indexing, Example: Binning Data, Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors, Structured Data: NumPy's Structured Arrays, Creating Structured Arrays, More Advanced Compound Types.	
C	UNIT 3 Data Manipulation with Pandas: Installing and Using Pandas Introducing Pandas Objects, The Pandas Series Object, The Pandas DataFrame Object, The Pandas Index Object, Data Indexing and Selection, Data Selection in Series, Data Selection in DataFrame, Operating on Data in Pandas, Ufuncs: Index Preservation, UFuncs: Index Alignment, Ufuncs: Operations Between DataFrame and Series, Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values, Hierarchical Indexing, A Multiply Indexed Series, Methods of MultiIndex Creation, Indexing and Slicing a MultiIndex,	10
D	UNIT 4 Rearranging Multi-Indices: ○ Data Aggregations on Multi-Indices, Combining Datasets: Concat and Append, Recall: Concatenation of NumPy Arrays, Simple Concatenation with pd.concat, Combining Datasets: Merge and Join, Relational Algebra, Categories of Joins, Specification of the Merge Key, Specifying Set Arithmetic for Joins, Overlapping Column Names: The suffixes Keyword, Example: US States Data, Aggregation and Grouping, Planets Data, Simple Aggregation in Pandas, GroupBy: Split, Apply, Combine, Pivot Tables, Motivating Pivot Tables, Pivot Tables by Hand, Pivot Table Syntax, Example: Birthrate Data, Vectorized String Operations, Introducing Pandas String Operations, Tables of Pandas String Methods, Example: Recipe Database, Working with Time Series, Dates and Times in Python, Pandas Time Series: Indexing by Time, Pandas Time Series Data Structures, Frequencies and Offsets, Resampling, Shifting, and Windowing, Where to Learn More, Example: Visualizing Seattle Bicycle Counts, High-Performance Pandas: eval() and query(), Motivating query() and eval(): Compound Expressions, pandas.eval() for Efficient Operations, DataFrame.eval() for Column-Wise Operations, DataFrame.query() Method	10
E	UNIT 5 Visualization with Matplotlib: General Matplotlib Tips, Importing matplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File, Two Interfaces for the Price of One, Simple Line Plots, Adjusting the Plot: Line Colors and Styles, Adjusting the Plot: Axes Limits, Labeling Plots, Simple Scatter Plots, Scatter Plots with plt.plot, Scatter Plots with plt.scatter, plot Versus scatter: A Note on Efficiency, Visualizing	05

	<p>Errors, Basic Errorbars, Continuous Errors, Density and Contour Plots, Visualizing a Three-Dimensional Function, Histograms, Binnings, and Density, Two-Dimensional Histograms and Binnings, Customizing Plot Legends, Choosing Elements for the Legend, Legend for Size of Points, Multiple Legends, Customizing Colorbars, Customizing Colorbars, Example: Handwritten Digits, Multiple Subplots, plt.axes: Subplots by Hand, plt.subplot: Simple Grids of Subplots, plt.subplots: The Whole Grid in One Go, plt.GridSpec: More Complicated Arrangements, Text and Annotation, Example: Effect of Holidays on US Births, Transforms and Text Position, Arrows and Annotation, Customizing Ticks, Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks, Three-Dimensional Plotting in Matplotlib 290 Three-Dimensional Points and Lines</p>	
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<p>Book Text: 1 Jake VanderPlas, “Python Data Science Handbook Essential Tools for Working with Data” O’Reilly 1st Edition 2. Gowrishankar S, Veena A, “Introduction to Python Programming” CRC Press/Taylor 3. AurelienGeron, “ Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems” O’Reilly, 1st Edition</p>
<p>Reference Book: 1. Wesley J Chun, “Core Python Applications Programming” Pearson 3rd Edition 2. Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python” O’Reilly, 2nd Edition</p>
<p>Online Resources: 1. NPTEL / SWAYAM lectures.</p>

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit
		L	P	Internal	External		
					ESE	PR	
MCS41MMP506	Practical Based on Python Programming		1	30	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.							
Course Objective	<ul style="list-style-type: none"> • Building robust applications using Python programming language's features, Understanding the usage of Python libraries. 						

List of Practicals:

Experiment No.	Experiment Topics	
1	Installing Python and Shell or Notebook?, Launching the IPython Shell, Launching the Jupyter Notebook	L1
2	Passing Values to and from the Shell, Shell-Related Magic Command, Errors and Debugging, Controlling Exceptions: %xmode	L1
3	Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Example: What Is the Average Height of US Presidents?	L2
4	Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors	L2
5	Data Indexing and Selection, Data Selection in Series, Data Selection in DataFrame, Operating on Data in Pandas, Ufuncs: Index Preservation, UFuncs: Index Alignment	L3
6	Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values	L3
7	Vectorized String Operations , Introducing Pandas String Operations, Tables of Pandas String Methods, Example: Recipe Database	L4
8	General Matplotlib Tips, Importing matplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File	L4
9	Text and Annotation, Example: Effect of Holidays on US Births, Transforms and Text Position, Arrows and Annotation, Customizing Ticks, Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks	L5
10	Three-Dimensional Plotting in Matplotlib, Three-Dimensional Points and Lines, Three-Dimensional Contour Plots	L5

Course code: MCS41MEL505

Course name: Intellectual Property Rights

Course category: Major Elective

Credits: 3

Pre-requisites: Basic knowledge Research

Course Objectives:

1. To make patent copyright, trademark application process known

Course Outcomes: At the end of the course, the students will be able to -

CO1: Understand Indian Patent Law

CO2: To understand Patent Data basis and Patent Information System

CO3: To Understand Preparation of Patent Documents

CO4: Understand the application procedure of patenting

Section	Topics to be Covered	No. of Lectures
A	<p>Unit I Indian Patent Law: Concept of Patent, Product / Process Patents & Terminology, The Patents Act, Amendments to the Patents Act, Patent Rules, Patentable Subject Matter and Patentability Criteria, Duration of Patents - Law and Policy Consideration, Elements of Patentability - Novelty and Non Obviousness, Procedure for Filing of Patent Application and Types of Applications, Procedure for Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Assignment and Licensing of Patents, Assignments of Patents, Working of Patents- Compulsory Licensing, Revocation of Patents by the Controller for Non-Working, Procedure in Respect of Compulsory License, International Applications, Patent Agent-Qualification and Registration Procedure.</p>	09
B	<p>Unit II Patent Data basis and Patent Information System: Patent Offices in India, Patent Information, What is Patent Information, Reasons for Using Patent Information, Patent Search & Patent Databases, Databases on CD-Rom, On-line Databases, Various Types of Searches using Patent Documentation, Pre-Application Searches (PAS), State-of-the-Art Searches, Novelty Searches, Patentability or Validity Searches, Name Searches , Technological Activity Searches, Infringement Searches, Patent Family Searches, Legal Status Searches.</p>	09

C	<p>Unit III Preparation of Patent Documents: Lab Notebooks/Log Books/Record Books, Methods of Invention Disclosure, Provisional Specification, Complete Specification, Patent Application and its Contents, Contents of Patent Application, Writing of Patent Document, Preparing Patent Applications, Obtaining Invention Disclosures from Inventors, Identifying Patentable Inventions, Understanding the Invention, Typical Parts of the Patent Application, Claims, Detailed Description or Specification, Detailed Description or Specification, Detailed Description or Specification, Abstract, Summary</p>	09
D	<p>Unit IV Process of Examination of Patent Application: Publication of Patent Application, Request for Examination, Request for Examination, Allocation of Application to examiner for examination, Examination of Patent Application: Regulatory Regime, Formal examination, Substantive Examination, Understanding the invention, Sufficiency of Disclosure: Technical or Specialized Terms, Scope of Claims, Scope of Claims, Scope of Claims, Single Inventive Concept, Patentability Criterion novelty, inventive step, industrial applicability, Prior Public Use, Prior Claiming, Industrial Applicability, Re-Issue and Re-Examination.</p>	09
E	<p>Unit V Patent Infringement: What Amounts to Patent Infringement, Types of Patent Infringement, Damages and Accounts for Profits. Trade Mark: Registration of Trade Marks, Registration Procedure. Copyright: Nature of Copyright Protection, Copyright Pertaining to Software, Term of Copyright, Registration of Copyright. Industrial Designs: What is a Design? Application and Registration of Design, Priority Document, Representation Sheet. Geographical Indications, Lay-Out Designs of Integrated Circuits, The Protection of Plant Varieties and Farmers Rights.</p>	09

Book Text: 1 “Intellectual property propertyrights- rights-laws and practice” The institute of company secretaries of india, Module 3 elective paper 9.3

2 NirajPanday,K D, “Intellectual property rights” PHI learning PVt ltd, 2014

Reference Book: 1. Chintakunta, Ramakrishna &Meka, Geethavani, “A textbook of intellectual property rights” 2022

Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MEP505	Practical Based on Intellectual Property Rights	--	1	30	--	20	50	1

L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.

List of Practicals:

At least two experiments should be carried out on each unit.

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Course code: MCS41MEL506**Course name:** React JS**Course category:** Major Elective**Credits:** 3**Pre-requisites:** knowledge of web development and JavaScript**Course Objectives:**

1. To build an interactive user interfaces and web applications quickly and efficiently with significantly less code

Course Outcomes: At the end of the course, the students will be able to -**CO1:** Enable developers to develop large web applications which can change data, without reloading the page**CO2:** Simplified Scripting**CO3:** Component-based architecture.**CO4:** Stable Code Structure**Contents-**

Section	Topics to be covered	No. of Lect.
A	UNITI: What is React?, React version history, anatomy of React project, working with React, Create element, Expressions, using logical operators, specifying attributes, significance of component architecture, Types of component, Component Composition	08
B	UNITII: Working with state and props What is state and its significance, Read state and Set state, Passing data to component using props, validating props using prop types, using React key prop, Understanding React event system	10
C	UNITIII: Working with forms Controlled components, Uncontrolled Components, Understand the significance to default Value prop, What is context?, When to use context, Create Context, Context Provider, Context Consumer, Reading context in class	10
D	UNIT IV: Code-Splitting : What is code splitting, why do you need code splitting, React lazy, Suspense Route-based code splitting, What are hooks, why do you need hooks, different types of hooks, using state and effect hooks, rules of hooks	08

E	UNITV: Templating using JSX Working with React, Create Element, Expressions, Using Logical Operators, Specifying attributes, Specifying children, Fragments, Understand the significance of unit testing	10
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Book Text: 1 Karl Rippan, "Learn React with typescript: Beginner's Guide to reactive" Edition 2
Reference Book: 1. Adam Boduch, Roy Derks, "React and React Native", Edition 4
Online Resources: 1. NPTEL / SWAYAM lectures.

Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Total	Credit
		L	P	Internal	External			
					ESE	PR		
MCS41MEP506	Practical Based on React JS	--	1	30	--	20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	Identify appropriate datamining algorithms to solve real world problems							

List of Practicals:

At least two experiments should be carried out on each unit.

Course code: MCS41MEL507

Course name: Neural Network

Course category: Major Elective

Credits: 3

Pre-requisites: Basic understanding of Digital Image Processing and Pattern Recognition

Course Objectives:

Identify different neural network architectures, algorithms, applications, and their limitations.

Course Outcomes: At the end of the course, the students will be able to -

CO1: Develop the skill in basic understanding on neural network.

CO2: Explore the Advanced methods of representing information in NN.

CO3: Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications

Contents-

Section	Topics to be Covered	No. of Lectures
A	<p>Unit I Introduction: Fundamentals of neural networks, Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Taxonomy of Neural network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules</p>	09
B	<p>Unit II Supervised Neural Networks: Standard back propagation algorithms, selection of various parameters, variations Applications of back propagation algorithms Single Layer Perceptron: functionality, libraries for SLP, Linear binary classifier, parts of perceptron, Perceptron convergence theorem, Method of steepest descent - least mean square algorithms, advantages, disadvantages</p>	09
C	<p>Unit III Supervised Neural Networks: Multi layer Perceptron: Effect of tuning parameters of the back propagation neural network. Selection of various parameters in BPN, Variations of standard back propagation algorithm, what are hidden layers, Derivation of the back-propagation algorithm, weights, activation's, network of neurons, training networks, Learning Factors, predictions, advantages and disadvantages.</p>	
D	<p>Unit IV Radial Basis and Recurrent Neural Networks: RBF network structure, RBF neurons, theorem and the reparability of patterns, RBF learning strategies, Training the RBNF, Advantages of RBNF, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .</p>	09
E	<p>Unit V Unsupervised Neural Networks: Adaptive Resonance Theory: Introduction, ART1, ART2, Kohonen Neural Network: Self-Organizing Feature Map, Learning Vector Quantization.</p>	09

Book Text: 1 Simon Haykin, “Neural Network a – Comprehensive Foundation” Pearson Education
2. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, **Addison Wesley, 2003**

Reference Book: 1. Zurada J.M, “Introduction to Artificial Neural Systems” Jaico publishers
2 S. Rajasekaran, and G. A. VijayalakshmiPai, “Neural Networks, Fuzzy Logic, & Genetic AlgorithmsSynthesis& Applications”, PHI

Online Resources: 1. NPTEL / SWAYAM lectures.

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Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			
					ESE	PR		Total
MCS41MEP507	Practical Based on Neural Network	--	1	30		20	50	1
L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.								
Course Objective	To Understand basic neuron models and learning algorithms by using Matlab's neural network toolbox, To Describe about different activation function (transfer function), To Analyze how weights & bias values affect the output of neuron, To Identify how weights & bias values are able to represent a decision boundary in the feature space, To Conceptualize about perceptron learning rule works for linearly separable problems.							

List of Practicals:

Experiment No.	Experiment Topics
1	To study MATLAB software and its toolboxes.
2	Write a program to implement MP Model.
3	Write a program for solving linearly separable problem using Perceptron Model.
4	Write a program for pattern classification using Perceptron Model
5	With a suitable example demonstrate the perceptron learning law with its decision regions using MATLAB. Give the output in graphical form
6	With a suitable example simulate the perceptron learning network and separate the boundaries. Plot the points assumed in the respective quadrants using different symbols for identification
7	Write a program for XOR function (binary input and output) with momentum factor using back propagation algorithm.
8	Write a MATLAB program to show Back Propagation Network for XOR function with Bipolar Input and Output
9	Write a program to store a pattern (1 1 1 0). Test the network using Discrete Hopfield Net by giving the input with mistakes in First and Second position
10	Program for Pattern storage of 10 digits with Discrete Hopfield Network

Course code: MCS41MEL508	Course name: Ethics and Cyber Security
Pre-requisites: Basic understanding of Digital Image Processing and Pattern Recognition	
Course Objectives:	
1. Identify Key concept and Terminology of Cyber Security. 2. Examine the concept of privacy and its legal protections. 3. Explain the primary concepts involving encryption. 4. Describe the social implications of cyber security. 5. Understand the risks and benefits of social networks.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: To understand fundamental cyber security concepts	
CO2: Explain technical and non-technical security solutions on different types of cyber systems.	
CO3: Identify attributes associated with cyber security professionals.	

Contents-

Section	Topics to be Covered	No. of Lectures
A	Unit 1 Introduction to Cyber Security and its Challenges in cyber security Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats: - Cyber Warfare-Cyber Crime-Cyber Terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.	09
B	Unit 2 Cyber Security Vulnerabilities and attacks Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.	09
C	Unit 3 Securing Web Application, Services and Servers Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.	09
D	Unit 4 Cryptography and Network Security Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography.	09
E	Unit 5 Cyberspace and the Law Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.	09

Book Text: 1 Yuri Diogenes (Author), ErdalOzkaya (Author) ' "Cyber security – Attack and Defense Strategies" Paperback, 2nd Edition

Reference Book: 1. Franke, Don, "Cyber Security Basics: Protect your organization", Paperback, 2nd Edition.

Online Resources: 1. NPTEL / SWAYAM lectures.

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Course Code	Course Title	Teaching Scheme		Evaluation Scheme			Credit	
		L	P	Internal	External			Total
					ESE	PR		
MCS41MEP508	Practical Based on Ethics and Cyber Security		1	30		20	50	1

L-Lecture, P-Practical, ESE-End Semester Examination, PR-Practical.

List of Practicals:

Experiment No.	Experiment Topics
1	1: Cyber Security Posture: Students conduct an 'audit' of their current cyber security behavior and readiness. This includes questions related to their computing devices (e.g., type, OS, version, security software installed, etc.), what files they back up, their home network configuration and how they decide to connect to WiFi networks outside of the home, password management, and social networking.
2	2: Understanding and Using Cryptography: Students install software to learn both encryption and steganography. For this various free software can be downloaded that provides full disk encryption, file encryption, and steganography. Students are asked to take screen shots of their activities, encode a message hidden within an image and send it to the instructor, as well as decode a message hidden in an image from the instructor.
3	3: Understanding the Threat Landscape: Students need to install anti-malware software and run a comprehensive scan on their computer. This includes downloading and installing free anti-malware software that works with their primary computing device (links are provided), running comprehensive scans of their computer with this software, taking a screen shot of the results, and answering several questions about different types of malware, historical examples of each type of malware, and what it does to a system.
4	4: Digital Forensics, Data Recovery, and Data Protection: Students install software that automatically backs up their computer as well as software that allows them to recover previously deleted files. This includes downloading and installing CrashPlan (local backup is free) and PhotoRec (free photo and file recovery tool). Students can be asked to use the photo and file recovery tool and identify anything interesting they found from the scan, including previously deleted files and files they did not know ever existed on their computer in the first place.
5	5: Privacy, Social Media, and Anonymity on the Web : Students install https everywhere, the Tor browser, learn about anonymous email services, and research how well they really know their Facebook/any social communication site friends. This includes visiting a few web sites and noting whether or not https is used, then installing https everywhere on compatible browsers and visiting those same websites

	<p>again. Generally speaking, students should now see that https is being used, when possible.</p> <p>With respect to their Facebook/ any social communication site friends, students had to identify the first 25 friends on their friends24list, how long they have known each of them, how well they know each of their friends, whether or not they met this friend in-person prior to becoming friends on Facebook/any social communication site, when they last saw this friend in-person (if ever), the last time they spoke to this person on the phone (if ever), and how close of friends they are with each person.</p>
6	<p>6: Managing Passwords :</p> <p>Students download and install a password manager and configure it appropriately for use. This includes deciding on a password manager that will suit their particular needs and answering several questions about authentication techniques, including the different factors and what is meant by two-factor authentication.</p>
7	<p>7 : Break A Caesar Cipher :</p> <p>Caesar cipher is a type of encryption method that was first used by Julius Caesar to communicate with his officials. This encryption technique is also considered to be one of the first methods which are still effective.</p> <p>The concept of Caesar cipher is simple — a letter of a given text is replaced by another letter that comes after a number of other alphabets. For example — Test: Apple Shift:5 Ciphertext: FUUQJ.</p> <p>To build a small web app that can break Caesar cipher.</p>
8	<p>8 : Packet Sniffing :</p> <p>Packet Sniffing, which is also known as network traffic analysis is all about taking a look at data packets that are sent across the internet and moves on your network.</p> <p>There are several tools available that capture packets such as tcpdump, Windump, Wireshark etc that can be used for packet sniffing.</p>
9	<p>Build a small application as an example of steganography.</p>